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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/058,578 | 01/28/2002 | Eiji Yamada | 245402004200 | 4309 |

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| EXAMINER | |
|---|---|
| LOUIE, WAI SING | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2814 | |

DATE MAILED: 10/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) |
|---|---|---|
| | 10/058,578 | YAMADA, EIJI |
| | Examiner | Art Unit |
| | Wai-Sing Louie | 2814 |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *09 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-6,8 and 9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8 and 9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-6 and 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogawa et al. (US 6,455,877) in view of Goetz et al. (US 6,441,393) and Yuasa et al. (US 6,518,602).

With regard to claims 1 and 3, Ogawa et al. disclose a group III-V light-emitting device (col. 6, line 23 to col. 24, line 51 and fig. 1) comprising:

- A silicon doped n-type GaN-based substrate 1002 (col. 12, lines 60-65), but Ogawa et al. do not disclose the GaN-based substrate 1002 containing chlorine. However, Yuasa et al. disclose an n-type GaN-based substrate grown by MOCVD process doped by silicon and chlorine (Yuasa col. 7, lines 51-53). Yuasa et al. teach the chlorine doping reduces the edge dislocations in the crystal (Yuasa col. 3, line 62 to col. 4, line 2). Therefore, it would have been obvious at the time the invention was made to modify Ogawa's device with the teaching of Yuasa et al. to dope the substrate with chlorine in order to reduce the edge dislocation in the substrate;

- A semiconductor stacked-layer structure including a plurality of nitride-based semiconductor layers 1003 to 1010 grown on the GaN-based substrate 1002 by MOCVD (col. 13, lines 30-47);
- Ogawa et al. do not disclose the GaN-based substrate having an interface region contacting the semiconductor stacked-layer structure, where the interface region containing oxygen atoms. However, Goetz et al. disclose the GaN layer is doped with silicon and co-doped with oxygen (Goetz col. 3, lines 36-48). Goetz et al. teach the Si doping causes the formation of cracks (Goetz col. 1, lines 20-24) and the co-doping with oxygen stabilizes the structure and improve conductivity of the Group III-V nitride materials (Goetz col. 2, lines 47-53). Therefore, it would have been obvious at the time the invention was made to modify Ogawa's device with the teaching of Goetz et al. to provide oxygen dopant at the interface region contacting the semiconductor stacked-layer structure. Doing so would alleviate cracking and improve conductivity of the structure. Ogawa et al. disclose the concentration at least $3x10^{18}$ $cm^{-3}$ (col. 4, line 46).

With regard to claim 2, Ogawa et al. disclose when the GaN-based substrate was made; GaCl was generated and would mix by the impurity doping gas. Therefore, the GaN-based substrate inherently contains chlorine (col. 9, lines 5-15).

With regard to claim 4, Ogawa et al. disclose the plurality of nitride-based semiconductor layers included in the semiconductor stacked-layer structure include a layer 1003 contacting the GaN-based substrate 1002 (fig. 11), and the layer contacting the GaN-based substrate contains oxygen (oxygen doped col. 8, line 3).

With regard to claims 5 and 8-9, Ogawa et al. disclose a group III-V light-emitting device comprising:

- A GaN-based substrate 2402 includes a p-type impurity (col. 18, line 61 to col. 19, line 2), but Ogawa et al. do not disclose the GaN-based substrate 2402 containing chlorine. However, Yuasa et al. disclose an n-type GaN-based substrate grown by MOCVD process co-doped with chlorine (Yuasa col. 7, lines 51-53). Yuasa et al. teach the chlorine doping reduces the edge dislocations in the crystal (Yuasa col. 3, line 62 to col. 4, line 2). Therefore, it would have been obvious at the time the invention was made to modify Ogawa's device with the teaching of Yuasa et al. to dope the substrate with chlorine in order to reduce the edge dislocation in the substrate;
- A semiconductor stacked-layer structure including a plurality of nitride-based semiconductor layers 2403 to 2410 grown on the GaN-based substrate 2402 by MOCVD (col. 19, lines 2-14);
- Ogawa et al. do not disclose the GaN-based substrate having an interface region contacting the semiconductor stacked-layer structure, where the interface region containing oxygen atoms. However, Goetz et al. disclose the GaN layer is doped with silicon and co-doped with oxygen (Goetz col. 3, lines 36-48). Goetz et al. teach the Si doping causes the formation of cracks (Goetz col. 1, lines 20-24) and the co-doping with oxygen stabilizes the structure and improve conductivity of the Group III-V nitride materials (Goetz col. 2, lines 47-53). Therefore, it would have been obvious at the time the invention was made to modify Ogawa's device

with the teaching of Goetz et al. to provide oxygen dopant at the interface region contacting the semiconductor stacked-layer structure. Doing so would alleviate cracking and improve conductivity of the structure. Ogawa et al. disclose the concentration at least $3x10^{18}$ $cm^{-3}$ (col. 4, line 46).

With regard to claim 6 and in according to claim 5 above, Ogawa et al. disclose the p-type impurity includes magnesium (col. 9, line 63).

***Response to Arguments***

Applicant's arguments filed 10/9/02 have been fully considered but they are not persuasive.

- Applicant points out in the remarks (bottom of page 4) that "Ogawa et al. (not in the reference Goetz) for a supposed disclosure that the concentration of oxygen dopant is at least $3x10^{18}$ $cm^{-3}$." However, Ogawa et al. disclose the n-type GaN-based substrate is doped with at least two n-type impurities, where the average of the first impurity concentration is at least $3x10^{18}$ $cm^{-3}$ and the average of the second impurity concentration is at most $3x10^{18}$ $cm^{-3}$ (Ogawa col. 4, lines 40-48). Ogawa et al. do not disclose the secondary dopant is oxygen. However, Goetz et al. introduces the oxygen as secondary dopant and the teaching of oxygen stabilizes the structure. Therefore, the combination of Ogawa with Goetz is proper and the quoted concentration in claims 1 and 5 are correct.

- Applicant argues that examiner is mixing the disclosure of Goetz with the disclosure of Ogawa in a way of contradicts the disclosure of either reference, i.e., it is not clear that the first portion, where the first impurity concentration is at least $3x10^{18}$ $cm^{-3}$, is an interface region. The examiner did not intermix the disclosures. In claims 1 and 5, the impurity concentration is at least $3x10^{18}$ $cm^{-3}$ (Ogawa col. 4, line 46), but examiner does not disclose it is the first portion or second portion. That is because the impurity concentration in both portions is at least $3x10^{18}$ $cm^{-3}$, which meets the claimed range of the present application. Ogawa et al. disclose the n-type GaN-based substrate is doped at least with two different impurities (Ogawa col. 4, lines 40-48) and Goetz et al. suggests co-doping with oxygen in order to alleviate cracking and improve conductivity of the structure. Therefore, Ogawa et al. modified by Goetz et al. is proper.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (703) 305-0474. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

wsl
September 30, 2003.

SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800